Sensitive and Accurate Detection of Magnetic Nanolabels for Biomedical Applications

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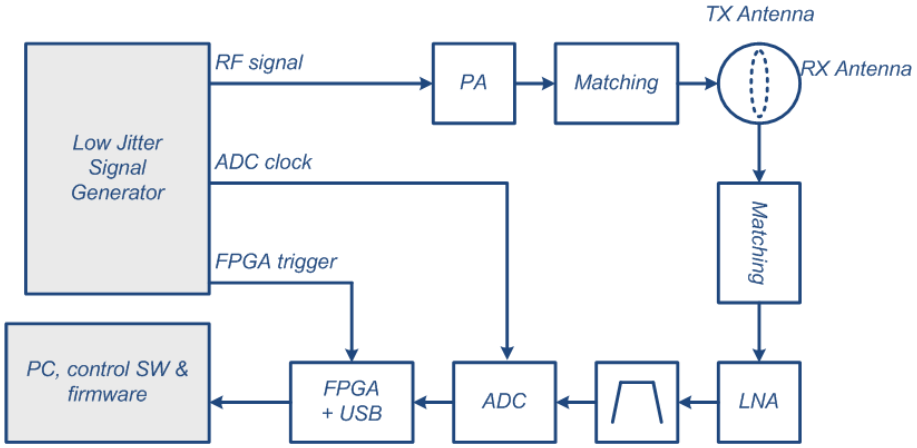
Detection of magnetic nanolabel studies the radiation signal from Nanolabels particle spin. When the labels located in orthogonal static magnetic field and electromagnetic field, the particle would precess around the static magnetic direction, and a radio frequency (RF) wave is generated spontaneously. By analyzing RF signal, the inner structure can be visualized.

The system is constituted by transmitter (TX) and receiver (RX), and the TX and RX are built around a set of antennas, placed in a strong static magnetic field. The TX is required to generate strong varying magnetic field, while the RX should capture the weak particle radiation signal from the strong RF signal transient as much as possible. Hence, the main challenge is to achieve sufficient signal to noise ratio (SNR). The SNR could be improved from each system block and system level. For block design, as shown in the figure below, the low jitter signal generator supplies both low jitter RF signal and ADC clock; the low jitter specs fulfills the high sensitivity requirement in analog-to-digital conversion process. For system design, beside the direct imaging architecture, homodyne and neutrodynisation are also study to integrate into the system to improve the SNR. Recently, the sensitivity has already been enhanced by a factor of 100, the promising result is already close to the traditional imaging technologies; the work is to be continued.



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